

MAXIMIZING LATENT IDENTIFICATION PERFORMANCE

NIST LATENT TESTING WORKSHOP

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Wally Briefs

**Senior Vice President
Cogent Systems, Inc**



Introduction

- **The Strength of Human Identification and Automated Identification**
Human vs. Machine
- **Incorporating Expert Knowledge Into Automated Identification Process**

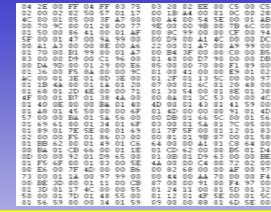
Human & Machine

Maximizing the Performance
"Lights-Out"

- **Thoughts on Latent Testing**



Human vs. Machine



- Logical analysis
- Image quality
- Finite Minutia determination
- Quick Comparison
- Expanded Comparison
- Final determination

- Processing algorithms
- Image quality
- Elimination techniques
- Overall comparison
- Expanded comparison
- Finite minutia determination
- Other Feature determination
- Final determination



Maximizing the Performance

- **Combining the strength of human and the power of machine**



Learning From Human Identification Process

■ Comparison Thought process

- Overall pattern
 - Candidate (yes/no)
- Finite minutia
 - Candidate (yes/no)
- Expanded minutia
 - Candidate (yes/no)



Learning From Human Identification Process



Overall pattern

- Visually eliminate background noise
- Determine ridge flow
- See the overall pattern for mental elimination



Learning From Human Identification Process



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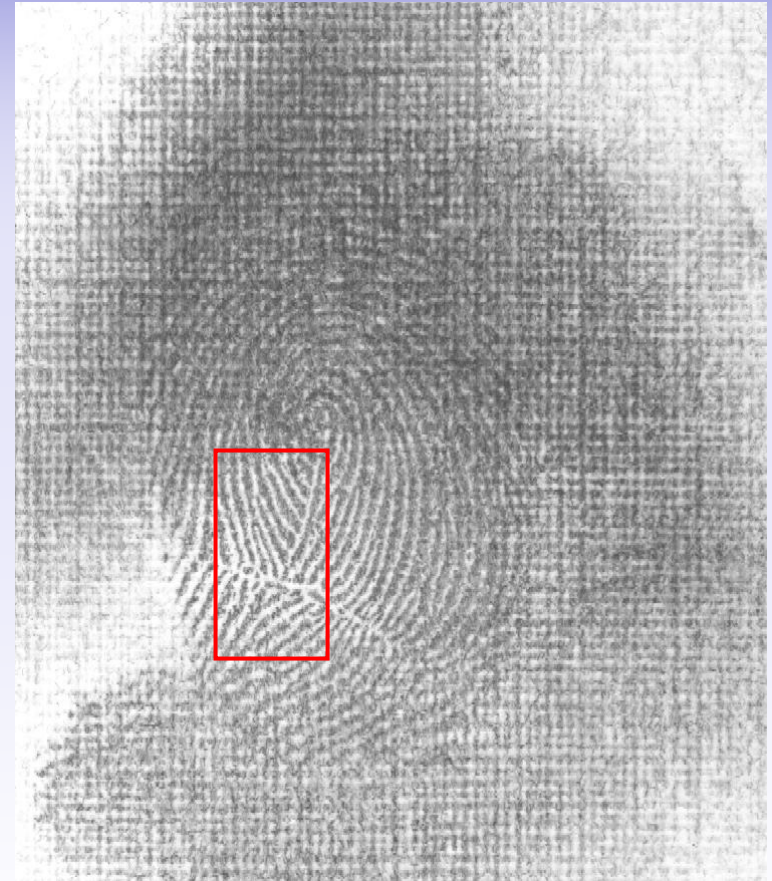


Learning From Human Identification Process



Finite Minutia determination

- Finding unusual ridge characteristic
- Lock into memory
- Use for quick mental elimination

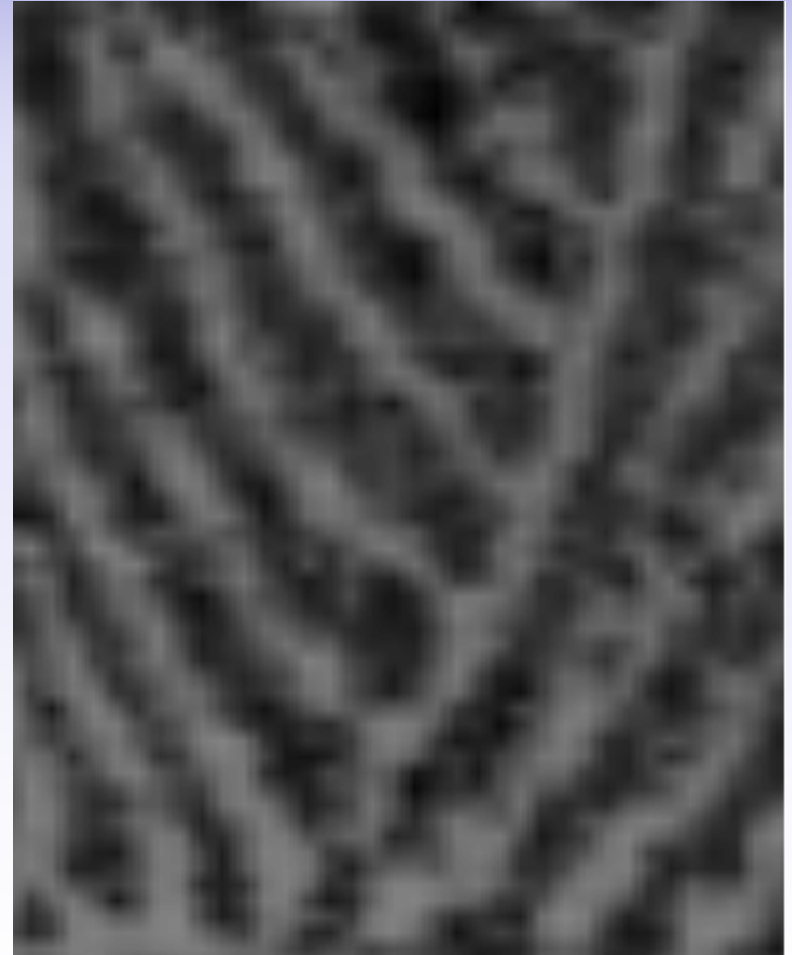


Learning From Human Identification Process



Finite Minutia determination

- Finding unusual ridge characteristic
- Lock into memory
- Use for quick mental elimination

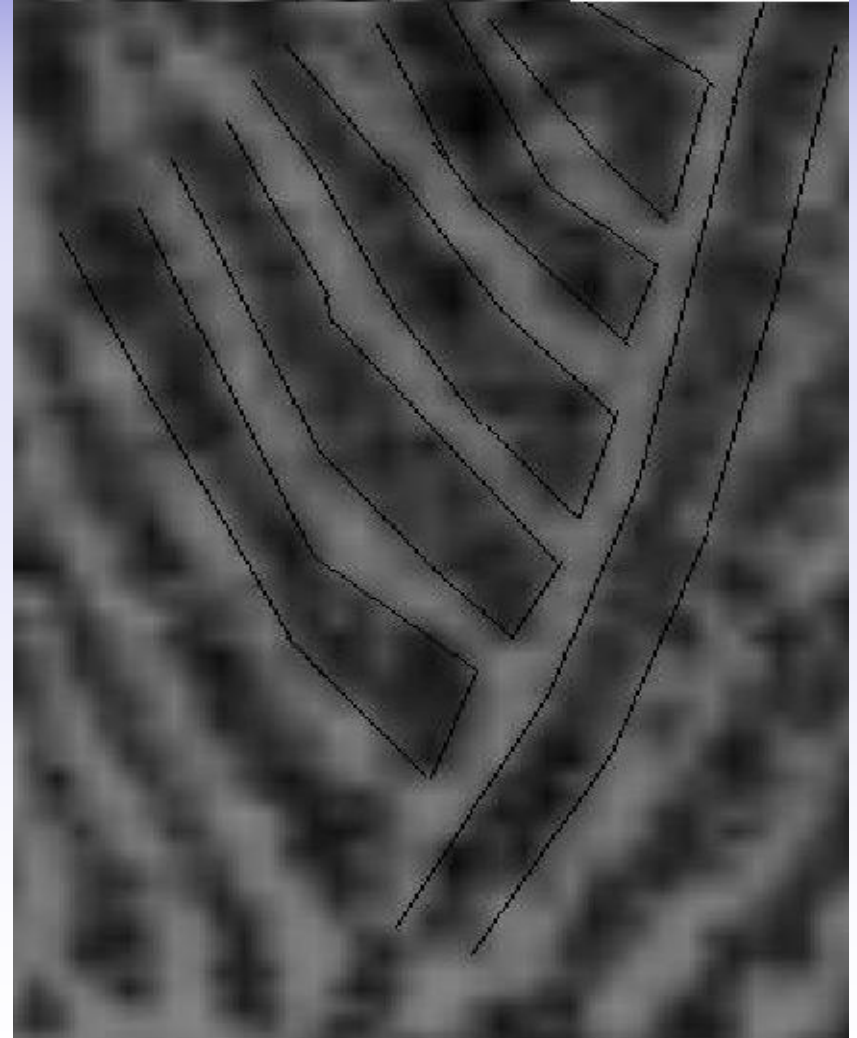


Learning From Human Identification Process



Finite Minutia determination

- Finding unusual ridge characteristic
- Lock into memory
- Use for quick mental elimination or further attention

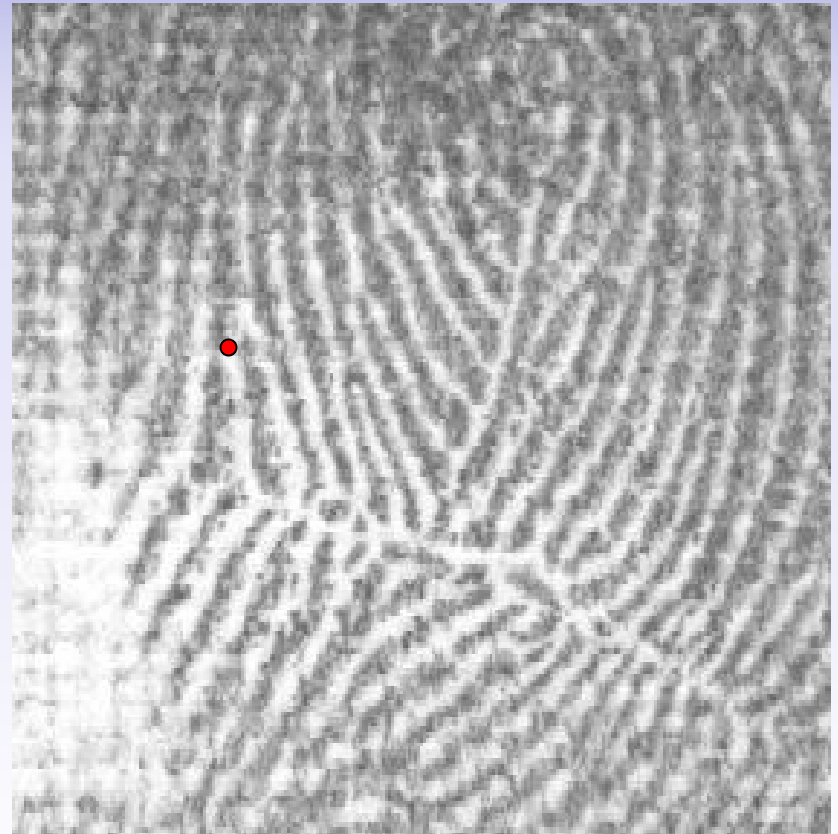


Learning From Human Identification Process



Expanded minutia

- Finding starting minutia point
- Locate nearest neighbor
- Continue until positive

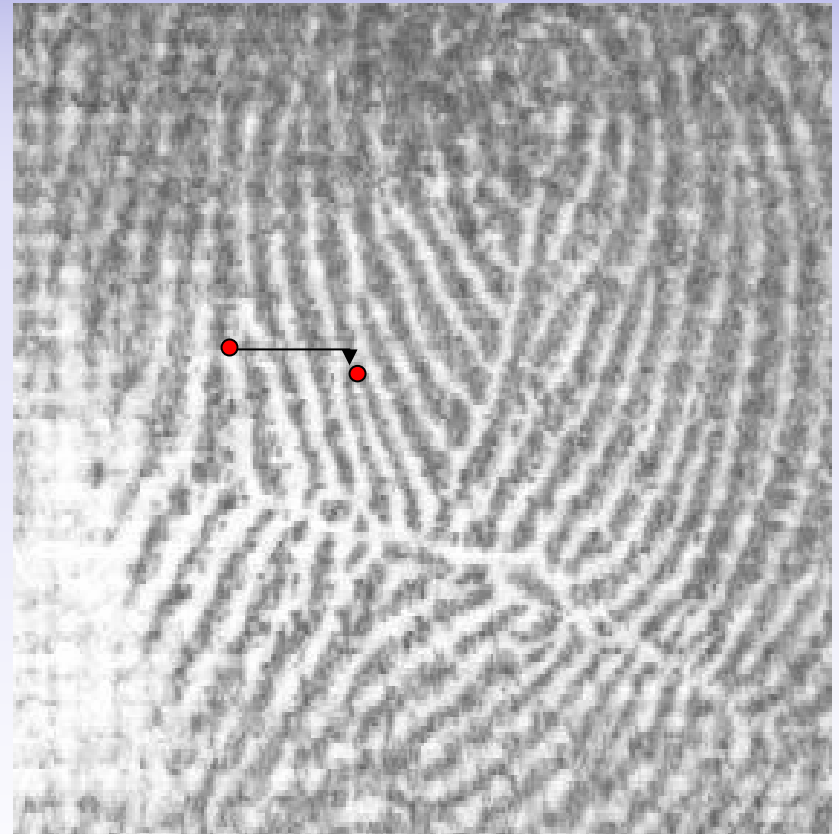


Learning From Human Identification Process



Expanded minutia

- Finding starting minutia point
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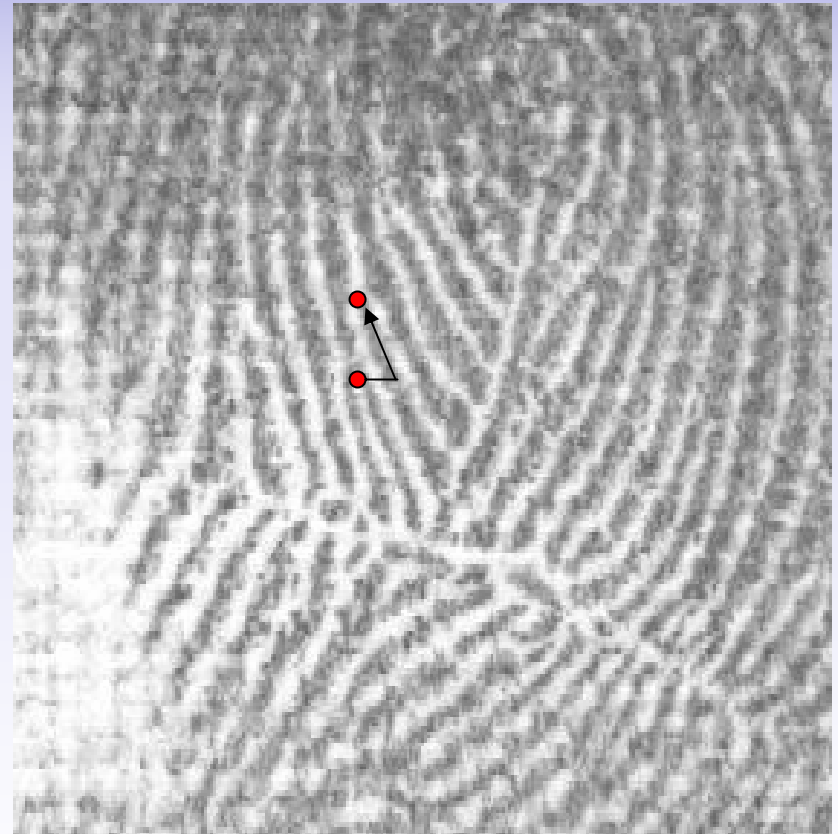


Learning From Human Identification Process



Expanded minutia

- Finding starting minutia point
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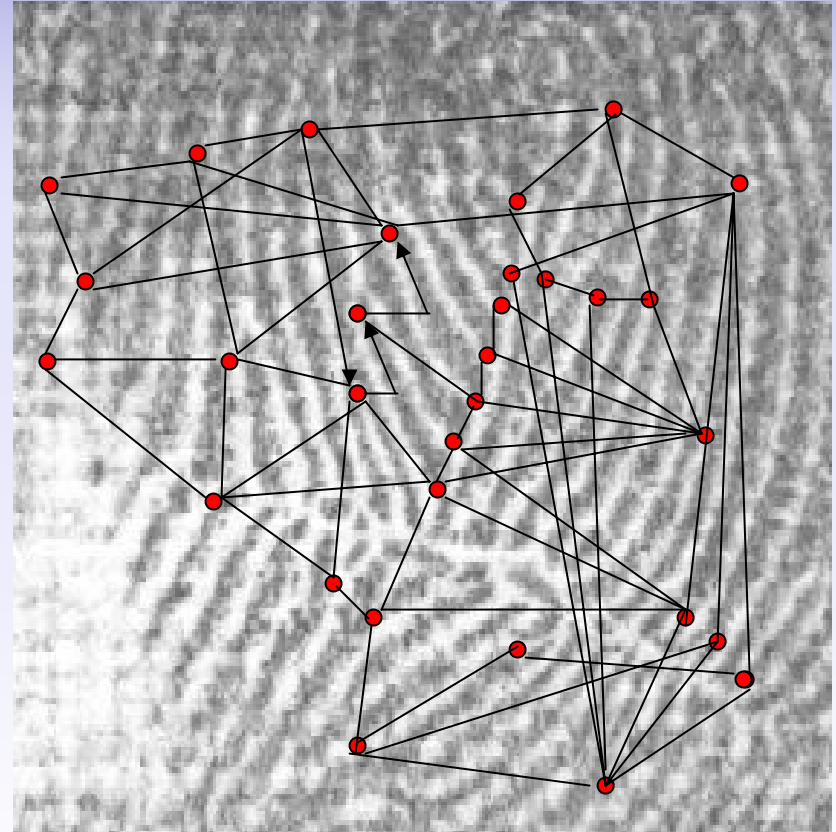


Learning From Human Identification Process



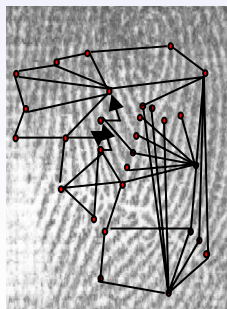
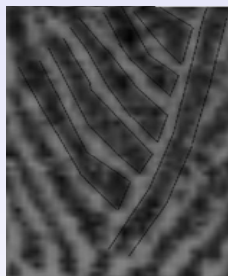
Expanded minutia

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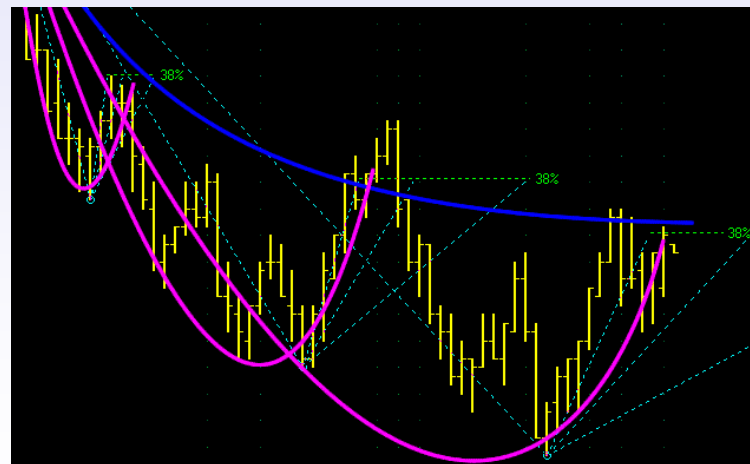


Human vs. Machine

- The strength of human identification lays on human's unparallel ability of analyzing and reasoning, and the rich knowledge on latent identification accumulated over years and generations.



- Algorithms are developed based on same identification process as human.
- The unique computing power enables AFIS to use algorithms that reveal and examine characteristics that are not apparent to human eyes.



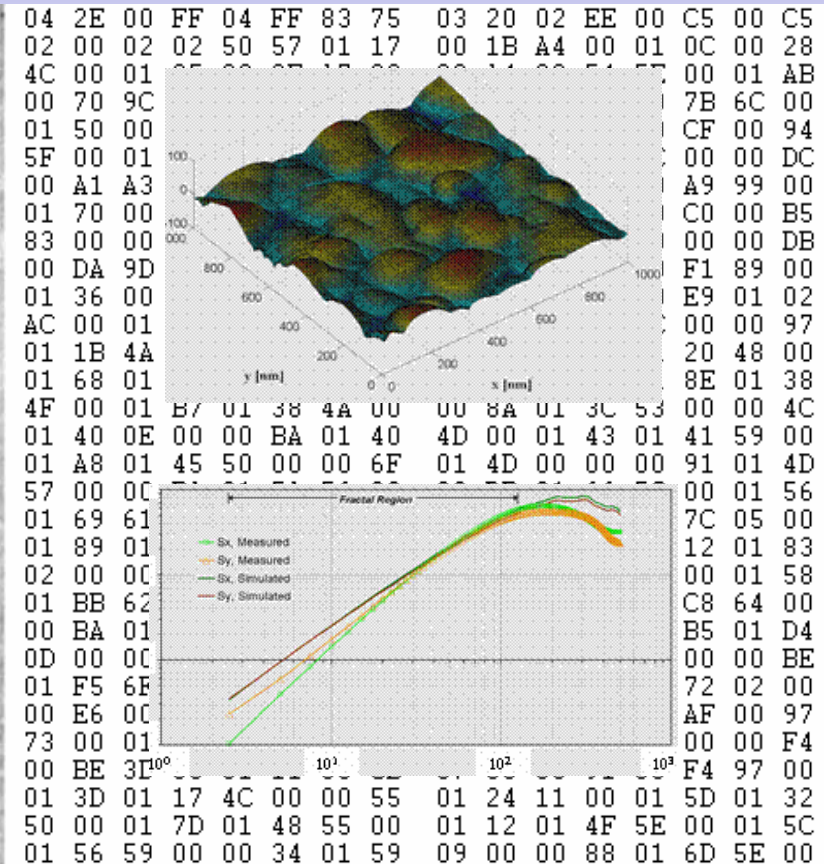
Automated Process

- Image Enhancement and analysis



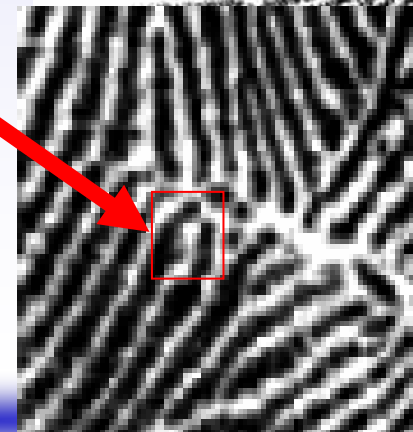
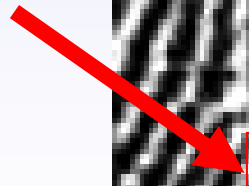
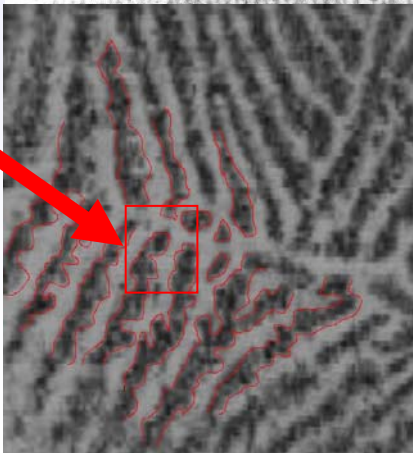
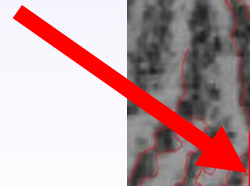
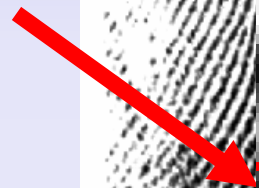
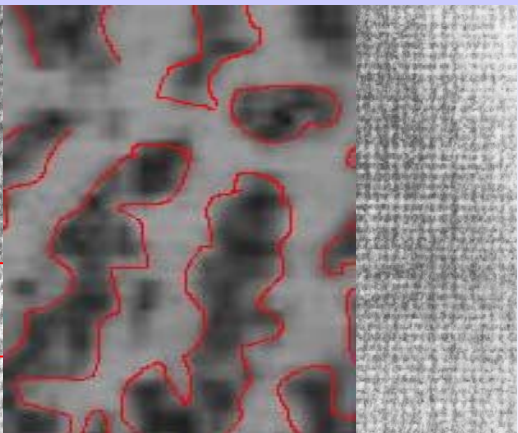
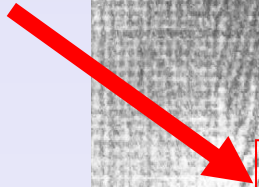
Automated Process

■ Detection and modeling



Additional Feature Sets For Increased Accuracy

3rd level detail is Very Usable



Lights-Out Latent searching?

DEAL or NO DEAL?

No control

- Number of hands in workflow
- Image quality
- Orientation
- Background noise

▪ Key to Lights-Out Application

What you can control

_Extracting reliable feature information out of noise background.

_With the same image, Multi algorithms can get more reliable features.

_Matching with reliable partial Information



Lights-Out Test: Benchmark

User defined lights out test for latents

Recent USER benchmarks included “lights out” latent testing, as well as “best practices”

Finger Latent vs. Tenprint

▪ Lights-Out Operation was two types:

- Auto process, no assistance (lights out- full)
- Auto process, lasso the area of minutia to use (lights out- semi)

What the user wanted to test, using their data:

- Successful results, using multiple algorithms.
- Real world, deliverable solution, not laboratory experiments

Some of these results:



Lights-Out Test: Benchmark

User defined lights out test for latents

Recent User benchmarks:

Lights out (full)

Lt-TP DB 200,000 tp (2 million fingers, rolled & flats)

- Hits 34/40
- Reliability 85% (all #1 position)
- Relative Reliability 85%

Lights out (full)

Lt-TP DB 250,000+ tp (2.5 million fingers, rolled & flats)

- Hits 65/91
- Reliability 71.43% (all in top 10)
- Relative Reliability 69.78%



Latent Testing

Can a CSI go to a crime scene, capture Latent images, transmit the images to a central AFIS without touching them and get good results now ?

The answer is YES!

- **But**, to get better results, more testing is needed, more fine tuning of algorithms.
- Independent testing (NIST) would be impacted by:
 - test set selection
 - _ The randomness of latent
 - _ Database makeup (rolled and flats?)
 - _ The interpretation of test results:
 - _ Relative reliability?
- The impact of capturing device (digital camera, flat bed scanner, etc)
- Capturing subject (training issue?)
- The impact of editing tools (semi lights out)
- The impact of training (semi lights out)
- more training of the "Mind's Eye"



The “Eyes” have it.



Thank You!



